of papers have been published with almost equal lack of precise and attested knowledge of the identity of the form treated.

Of course some workers are more careful than others. E. B. Wilson seems to me to be a man who wishes to know exactly what he is working with. The same may be said for J. T. Patterson and for S. I. Kornhauser and others, but on the whole I think that this suggestion is worth while and I hope that it will appeal to many.

L. O. HOWARD

SCIENTIFIC BOOKS

The Anatomy of Woody Plants. By EDWARD CHARLES JEFFREY. University of Chicago Press, Chicago. October, 1917. With 306 illustrations. Pp. x + 478. Price $4.

This work, by the well-known professor of plant morphology in Harvard University, has been expected with much interest. The expression in the Preface, "Woody or so-called vascular plants," suggests that the two terms are synonymous, and, as a matter of fact, herbaceous forms are by no means neglected, though special prominence is given to the woody types, in accordance with the author's belief in their primitive nature.

Great stress is laid throughout on the supposed "Canons of Comparative Anatomy" formulated in Chapter XVII. It is even stated in the Preface that "any conclusions not in harmony with them have ordinarily not been considered" (with certain exceptions). This at once indicates the highly deductive character of the treatment, though the word "induction" is often used. The book, in fact, is essentially an able exposition of the views of Professor Jeffrey and his school; it will therefore be read with the most advantage by those who are in a position to read critically.

The general plan of the book is as follows: After a short chapter on the cell, we come to the tissue-systems. Next follows a chapter on wood in general, succeeded by four on the secondary wood and one on the phloem. The epidermis and the fundamental tissues occupy Chapters IX. and X. Then we have a chapter on the definitions of the organs, succeeded by three on the root, stem and leaf, respectively. Then follow two chapters, which it is a welcome surprise to find in an anatomical textbook, on the microsporangium, and on the megasporangium and seed. We then arrive at the important Chapter XVII., which lays down the author's "Canons of Comparative Anatomy." The arrangement of the next twelve chapters is systematic, from the Lycopodiales to the Monocotyledons. Chapter XXX. is an anatomical structure and climatic evolution; Chapter XXXI. treats of the evolutionary principles exhibited by the Compositae, and the last chapter is devoted to anatomical technique. The arrangement involves a certain amount of repetition, which, however, serves to bring out the points on which the author desires to lay special stress.

In defining the tissue-systems the author returns to Sachs's old divisions, the epidermal, fibrovascular and fundamental systems. The stele, so prominent as an anatomical unit in the work of the last quarter of a century, thus disappears; it is rarely mentioned and is not to be found in the index. This striking reversion in terminology is intimately connected with the author's theory that the pith is of common origin with the cortex and so does not belong to the central cylinder.

Much attention is given to the wood (especially the secondary wood) as this is the tissue for which the best fossil evidence is available; The libriform fibers are derived from tracheides, not from parenchyma as Strasburger held. Evidence is given also for the origin of xylem-parenchyma and of the so-called medullary rays from tracheides, and some excellent new figures of Lepidodendroid structure are furnished, in support of this view.

The statement (p. 49 and elsewhere) that tangential pits are absent in Palæozoic woods, is erroneous; they have long been described in *Pitys antiqua* and also occur in *Mesoxylon multirame* and doubtless in other species. In Chapter VII. there is an excellent comparative account of xylem-vessels in Gnetales and Angiosperms.

The epidermis is said to be of "relatively slight phylogenetic interest." Yet the stoma is probably the most conservative organ of plants.

The common term *medullary* rays is repeatedly condemned, on the ground that their relation to the pith is only a "semblance," due to obsolescence of the primary wood. This may be true, but the relation is of very old date, for it was already well established in the Calamites and some of the Cycadofilices. From the author's point of view the wide ray is a compound one, derived from the aggregate type of ray; the vascular bundles were not originally separate, and the statements of Sanio and Sachs as to the bridging over of the primary gaps by interfascicular cambium are rejected. They are, however, true, as a description of the facts, and hold good for the young Calamite as well as for more modern plants.

On the general question of the relation of herbaceous to arboreal types, it may be pointed out that there is no proof that our existing herbaceous Lycopods came from arboreal ancestors; the herbaceous *Selaginellites* was contemporary with the arboreal Lepidodendreæ. The siphonostele is held to have primitively possessed phloem on the inner as well as the outer surface. This type of structure, however, is rare among Palæozoic plants.

In the chapter on the Microsporangium the author adopts the view that the higher plants arose from forms like the thallose Liverworts, and quotes Bower's "Origin of a Land Flora" in support of this theory. No mention is made of Professor Bower's subsequent change of view.

The "Canons of Comparative Anatomy" which the author insists on are three in number—Recapitulation, Conservative Organs and Reversion. The doctrine of recapitulation in the development of the individual of the history of the race is well known, though no longer accepted without question. The author points out that *negative* evidence is of little or no value, but doubts may arise as to what testimony *is* negative; in a pine-seedling, for example, short-shoots are absent, but foliage-leaves on the main stem are present.

Among conservative organs the leaf is first cited, and then the reproductive axis. The present writer is given the credit for the latter idea; it belongs rather to Solms-Laubach, but neither generalized the conclusion, which was confined to the peduncles of Cycads. Floral axes are subject to modifications of their own, and are not necessarily conservative. As regards the root, the primary structure is no doubt highly conservative, but it does not follow that the same is true of its secondary modifications.

The word "reversion" is used in a peculiar sense, for certain effects of wounding, believed by the author and some others to be reminiscent of ancestral characters. This doctrine has hitherto been employed only in support of certain controversial opinions, and has not yet been adequately subjected to impartial criticism.

The worst of all such "canons" is that every writer applies them as suits his individual views, and treats inconvenient cases as exceptions.

In the systematic part of the book we first come to the author's well-known division of the higher plants into Lycopsida, without, and Pteropsida, with leaf-gaps in the vascular ring, a classification widely accepted, though it is now realized by many botanists that Sphenophylls and Equisetales have little in common with the Lycopod group.

The author's doctrine of the cortical origin of the pith is applied even to the Lycopods, where the evidence seems peculiarly unfavorable to this interpretation. It is a pity that the exact developmental processes involved are not more clearly explained.

The author's views on the evolution of the Osmundaceæ are well expounded, and a strong case made out, which would have been more convincing if the facts on the other side, brought forward by Kidston and Gwynne-Vaughan, had been dealt with.

The lower seed-plants are divided into Archigymnospermæ, including Cycadofilicales, Cycadales, Cordaitales and Ginkgoales, and

Metagymnospermæ consisting of the Conifers and Guetales. It is well point out that *Ginkgo* forms a link between the two main divisions. The long chapter on Coniferales is chiefly devoted to an exposition of the author's well-known view of the primitive position of the Abietineæ, and especially of *Pinus,* and the derivation of the ancient Araucarineæ from that group. This hypothesis is maintained with great ingenuity, in the face of much inherent improbability. The opposite view of the direct derivation of the Araucarineæ from their immediate Palæozoic predecessors, the Cordaiteæ, has been considerably strengthened by the work of Boyd Thomson and Burlingame.

The view, maintained by Wieland and his followers, of an affinity between the Bennettitales and the Angiosperms, is rejected. In this connection it may be pointed out that we have no actual proof that fertilization in *Bennettites* was by spermatozoids, as the author assumes.

The chapter on Herbaceous Dicotyledons is important, for it sets forth in detail the author's theory of their derivation from arboreal ancestors, a view which is well worthy of consideration. The author believes that the fresh and vigorous herbaceous vegetation will tend in future to supplant the forest trees; he has no such hopes, however, for the Monocotyledons, which he acutely remarks (p. 198), may be said to represent the second childhood of the vascular plants. "This group seems to have reached such a high degree of specialization that it will probably in the long run entirely disappear and be replaced by new derivatives of the still plastic dicotyledons" (p. 416). Such a consummation, however, is not likely to be reached while man remains dominant.

In the chapter on anatomical structure and climatic evolution, the question of annual rings is considered. While the author finds no such rings in Cordaitean wood from Prince Edward Island (Lat. 46° 30′) he believes that they are present in contemporary wood from Lancashire (Lat. about 53° 30′). The difference of latitude seems too small to be significant, and most appearances of annual rings in Carboniferous woods from any source are fallacious.

Chapter XXXI. is on a special subject, the evolutionary principles exhibited by the Compositæ, and is chiefly concerned with the somewhat narrow question of the distribution of oil-canals.

The concluding chapter is on anatomical technique, including the sectioning of coal and photomicrographic methods. On all these subjects the author is an acknowledged expert, and his counsels will be of the greatest value to practical workers.

The index might perhaps have been made fuller with advantage. No references are given in the book; the accumulation of references often becomes a burden, but a few would have been of service to the reader as a guide to his future studies.

In the present notice, attention has often been directed to points which seem open to criticism, or on which there is much difference of opinion. These divergences of view in no way detract from a high estimate of the great interest and complete originality of Professor Jeffrey's remarkable work.

The illustrations, as one would expect in a book by this author, are abundant and excellent.

D. H. S.

SPECIAL ARTICLES

ON THE SERIES IN THE ULTRA-VIOLET FLUORESCENCE OF SODIUM VAPOR

In two papers[1] published by Professor J. C. McLennan an account of the extension of Professor Wood's iodine vapor spectrum into the ultra-violet is put forth. Professor McLennan has not only proved that the resonance spectrum can not be obtained in the violet, but has also proved "that we have to do here with a case of ordinary fluorescence where Stokes's law is followed and where fluorescence is stimulated by the light from any one of a number of wave-lengths of a limited portion of the spectrum." In this case the fluorescence spectrum begins at $\lambda 4600$ and extends to $\lambda 2100$,

[1] J. C. McLennan, *Proc. Roy. Soc.*, LXXXVIII., p. 289; XCL., p. 23.